

ECOLOG

2000 Annual Vegetation Management Plan for the Rocky Flats Environmental Technology Site



June 2000

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ACRONYMS AND ABBREVIATIONS

APRS	Alien Plant Ranking System	
CAQCC	Colorado Air Quality Control Commission	
CDA	Colorado Department of Agriculture	
DOE	U.S. Department of Energy	
IWCP	Integrated Work Control Package	
K-H	Kaiser-Hill Company, L.L.C.	
RFCSS	Rocky Flats Closure Site Services	
Site	Rocky Flats Environmental Technology Site	
USC	U.S.	Congress

Purpose

Invasions of non-native vegetation at the Rocky Flats Environmental Technology Site (Site) are degrading existing habitat quality, reducing the coverage of the Site's high-value vegetation communities, and adversely affecting the conservation of Buffer Zone resources. To exercise good stewardship, preserve the natural resources in the Buffer Zone, and to comply with regulations, it is necessary to control existing and future infestations of weeds (DOE 1998). This Vegetation Management Plan provides a framework for protecting the natural resources of the Site Buffer Zone and perpetuating native plant communities during FY2000. This plan targets the major effort at the species that present the greatest threat to native plant communities.

As stated in the Site Integrated Weed Control Strategy (K-H 1997), an annual weed control plan (as incorporated in this Vegetation Management Plan) will be produced to outline the weed control strategy for each fiscal year. This document serves that purpose for FY2000. Table 1 lists the weed control methods that are incorporated into the plan.

The following integrated weed control actions are proposed for FY2000. Although no single weed control effort or strategy will completely remedy the noxious weed problems at the Site, this plan seeks to integrate various techniques to provide effective weed control, while minimizing environmental damage and optimizing the use of available resources and funds. The measures are listed in the order they should be considered from an integrated weed management viewpoint, starting with the least toxic, non-chemical measures. Implementation of these actions will involve a joint effort between the Kaiser-Hill Company, LLC (K-H) Ecology Group and Rocky Flats Closure Site Services (RFCSS) Roads and Grounds personnel. This plan concentrates primarily on weed control in the Buffer Zone, with acknowledgment that noxious weed control, as well as complete vegetation control in specified areas, will also occur in the Industrial Area as well.

Vegetation Management Plan for FY2000

Weed Ranking System

During the winter of FY2000, noxious weeds (legally listed as "state noxious weeds" by the State of Colorado) that are known to occur at the Site were prioritized for control. Ranking was conducted using the Alien Plants Ranking System (APRS; Version 5.0) developed by Ron Hiebert of the National Park System and Jim Stubbendieck of the University of Nebraska. The software, available free on the internet (<http://www.ripon.edu/faculty/beresk/aliens>), is described by the developers as

"...a computer program which allows the user to compare the impacts, current and potential, of nonnative plant species on a particular land area or site, and to consider the feasibility and urgency of taking control measures against particular exotic species. APRS is a tool to help managers evaluate the threats posed by nonindigenous plants. A data file for the site consists of a DataSheet for each alien species. The DataSheet has 23 questions which must be answered with reference to how the plant behaves on this particular site. These questions assess the ecological impacts of the species and its potential to become a pest. Following a thorough plant inventory, the data file for the site may be created by answering the questions for each alien species. This information is then processed to create graphs and reports indicating how each species ranks according to its level of impact, ease of control, and the urgency of management efforts."

Although 32 species of state listed noxious weeds are known to occur at the Site (Table 2), only those on the Colorado top ten weed species prioritized for control (Table 3) and others considered problems specific to the Site were ranked for control at this time. This was done to simplify the ranking effort and due to the fact that many of the other state listed species, although occurring on the Site, are only found at isolated disturbed areas. Many of these latter species are also not aggressive, invasive species that are having a significant impact on the native plant communities at the Site. In the future the other listed species may be included in the ranking as necessary. The results of the analysis are shown ranked in descending order of impact to native plant communities (Table 4). Figure 1 graphically compares the species on the basis of their impact on the plant community versus their difficulty of control. The species with the greatest potential impact the native plant communities and greatest difficulty of control are diffuse knapweed, Canada thistle, Russian knapweed, and dalmatian toadflax. The aggressive nature, and ability of these species to dominate and replace the native plant communities, makes control of these species especially urgent. Annual rye, another species having an impact, but easier to control, is of concern at the Site because it has also begun to invade the surrounding native prairie, at several locations, creeping in from the roadside edges where it originated.

In order to determine how, when, and where to expend limited resources for noxious weed control it is important to prioritize the species. Table 5 lists the prioritized weed species at the Site. Species were given priority one, two, or three status on the basis of the above ranking system results, their need for control on the Site, and the difficulty of control. Note the table contains the state listed noxious weed species as well as a few others not listed by the state but which are considered problems at the Site. Not all of these species are slated for control during FY2000, however.

The priority one species slated for control in FY2000 at the Site are diffuse knapweed, Russian knapweed, and Canada thistle. Diffuse knapweed is the greatest threat because of the aggressive, invasive character of the plant and its ability to invade and dominate undisturbed native plant communities at the Site. Additionally, annual weed mapping has shown it is present across large portions of the Site and it is important to contain its spread before it completely infests the Site. Russian knapweed is a high priority because of its similarly aggressive nature, but also because it currently occupies only about one acre, making control and eradication possible at this point. Canada thistle is currently found throughout most of the wetland and riparian areas on the Site. Its similarly aggressive nature, continuing expansion, and difficulty of control make it important to control of as well. However, the fact that it occurs in wet areas makes effective control difficult because mowing and herbicides cannot be used effectively in many areas. There are however, some drier locations where mowing, combined with herbicides could begin to provide effective control over time at these locations.

Priority two species slated for control in FY2000 are annual rye, Scotch thistle, dame's rocket, Russian olive, musk thistle, common mullein, common St. John's-wort, and bouncingbet. These species have been selected because the infestations are currently restricted to small isolated patches that can more easily be controlled than many of the other species shown in Table 4, or they are in areas that will be treated as part of the aerial herbicide application for diffuse knapweed. For the species with small infestations it is important to begin control of these immediately to keep them small and hopefully completely eradicate them from the Site.

The priority 3 species are currently not slated for any specific control measures during FY2000. This could change in the future as some of the higher priority species are brought under control. Some of the priority 3 species may be impacted by efforts directed at other target species, but no specific efforts are currently being directed at them. Dalmatian toadflax, although one of the species needing control at the Site because of its impact to the native plant communities, is a considerable challenge because it is extremely difficult to control. Currently no effective management scheme exists for its control at the scale the problem exists at the Site. Based on small plot trials on the Site, certain herbicides such as Tordon 22K or Telar *can* effectively control and kill the species, but *only* at application rates that eliminate all the other forbs in the plant community. Mechanical control, which to be effective requires tillage, is not an option because of the management goal to preserve the prairie. Currently no effective biological controls exist for dalmatian toadflax. Therefore it has been classified as a priority three species and no specific control effort is slated for this species in FY2000.

Species Specific Control Efforts Slated for FY2000

The following control methods are proposed for priority one and priority two species at the Site during FY2000. No control is slated for priority three species during FY2000.

Priority 1 Species

Diffuse Knapweed

- Mowing along main access roads and Buffer Zone fire break roads. In addition, mowing trials will be conducted at selected locations in the Buffer Zone where previous herbicide applications have been made to try and extend the period before re-treatment with herbicides is necessary.
- Hand pulling/wicking will be conducted at selected locations where aerial herbicide applications were made during FY1999, to keep the area free of all adult, seed producing plants during FY2000. This experimental treatment will evaluate the feasibility of hand control (hand pulling/spot herbicide application) to keep an area free of seed producing plants during the years following large-scale broadcast herbicide treatments to gain initial control.
- Ground and aerial application of Tordon 22K and Transline herbicides will continue at selected locations in the Buffer Zone.
- Controlled burning at selected locations in the Buffer Zone to stimulate germination and increase susceptibility to subsequent herbicide application.

Russian Knapweed

- Ground herbicide applications of Tordon 22K will be made to control the small (~ 1 acre) infestation of Russian knapweed found at the Site.
- Late fall reseeded with native perennial grasses will be conducted to begin to reestablish a native cover in the area.

Canada Thistle

- Mowing, combined with application of the herbicide Transline, will be conducted at a selected location in Walnut Creek to begin control of a large infestation that has been expanding in that area during the past few years.

Priority 2 Species

Annual Rye

- Mowing will be used in the xeric tallgrass prairie to prevent seed set in a large infestation of annual rye along a firebreak road in the north Buffer Zone.
- At several locations in the southeast Buffer Zone where there are smaller infestations, sickles will be used to prevent seed set.
- Controlled burns in some areas may impact some seedlings if the seeds have germinated at the time of the burn.

Scotch Thistle

- Hand pulling, sickles, and spot herbicide treatments with Roundup will be used to control the few small infestations remaining at several locations in the Buffer Zone.

Dame's Rocket

- Hand pulling, sickles, and spot herbicide treatments with Roundup will be used to control the small infestations west of the A-series ponds in the Buffer Zone.

Bouncingbet

- Hand pulling, sickles, and spot herbicide treatments with Roundup will be used to control the few small infestations at several locations in Rock Creek.

Russian Olive

- The isolated trees occurring on Site will be cut down and the trunks treated with Roundup to prevent regeneration. As an alternative to this trees will be girdled and Roundup sprayed into the girdled area.

Musk Thistle and Common Mullein

- Ground and aerial herbicide applications will be used to control several infestations of these species as part of the larger spraying effort to control diffuse knapweed.
- Controlled burning at some locations will remove plant litter thus allowing better effectiveness of post-burn herbicide applications.
- Musk thistle control insects will be monitored to ensure that populations continue to be present at the Site.

Common St. John's-wort

- Foliage feeding beetles, *Chrysolina quadrigemina*, will be collected from currently controlled common St. John's-wort infestations and transplanted to the infestation east of the Lindsay Ranch in Rock Creek where the insects are not numerous.

Administrative and Cultural Control (Prevention)

The administrative and cultural control elements of the proposed Vegetation Management Plan include the following:

- All revegetation and reclamation projects at the Site will use weed-free topsoil, seed, and mulch sources. Seed mixes will be composed of appropriate native species for the locations.
- Weed control and reseeding will be a part of all revegetation and reclamation efforts for a minimum of two years after their initiation (i.e., three years in total). Budgets for all projects requiring revegetation should include funding for these efforts. Ecology personnel will interface with all Site organizations and managers to ensure that weed-free materials are used on revegetation projects and that approved revegetation plans are used. The K-H Ecology Group will be the point of contact for information concerning these issues.
- Any new noxious weed species found on the Site will be controlled immediately to reduce their population and prevent their future increase.
- The following graminoid species shall not be used in seed mixtures for reclamation and revegetation projects on Site:
 - Annual rye grass *Secale cereale*
 - Bulbous bluegrass *Poa bulbosa*
 - Crested wheatgrass *Agropyron desertorum* or
 Agropyron cristatum
 - Intermediate wheatgrass *Agropyron smithii*
 - Johnsongrass *Sorghum halepense*
 - Orchardgrass *Dactylis glomerata*
 - Quackgrass *Agropyron repens*
 - Sheep fescue *Festuca ovina*
 - Smooth brome *Bromus inermis*
 - Timothy *Phleum pratense*
 - Wild proso millet *Panicum milaceum*
- All seed mixtures for Site reclamation and revegetation projects must be approved by the K-H Ecology Group.

Physical or Mechanical Control

Grading

Grading of Buffer Zone roads should be continued in FY2000 as a mechanical method of weed control along the unpaved roads, in addition to other methods. The grading should not widen the roads. If budget and manpower are available, it is recommended that the roads be graded at least twice per growing season, with specific times for grading determined by the K-H Ecology Group and transmitted to RFCSS, to ensure the greatest effectiveness on roadside weeds. A map of the roads to be graded during FY2000 (Figure 2) will be provided to RFCSS to ensure that only specific roads slated for grading are graded. Approximately 18 miles of Buffer Zone roads are scheduled to be graded during FY2000 (approximately 66 acres).

Mowing

In addition to the roadside grading in FY2000, mowing is also recommended along the edges of certain Buffer Zone roads, and along all Site access roads, to keep the weeds cut back. Mowing will stress the weeds and also reduce seed production. Mowing is also conducted for aesthetic purposes in certain highly visible locations. Mowing could be done along any of the roads slated for grading, if grading is not possible in these areas. Figure 2 shows the roads slated for mowing during FY2000. Approximately 113 acres are scheduled for mowing along the roadsides during FY2000.

In addition to mowing along roads, mowing is also recommended at some off-road Buffer Zone locations for control of annual rye (*Secale cereale*) and Canada Thistle (*Cirsium arvense*; Figure 2). The annual rye locations will be mowed during flower production (but before seed set) to eliminate the annual production of seed. Application of this methodology for the next few years should eventually eliminate the annual rye from these locations by preventing annual seed production and exhausting the seed bank. At a large (approx. 7 acre) Canada thistle infestation in Walnut Creek, mowing possibly combined with chemical control will be used during FY2000 to begin to evaluate the potential of this method for controlling Canada thistle populations on the Site. Mowing should be conducted at least twice during the growing season.

Hand Control

Hand control, primarily hand pulling, using sling blades or sickles, spot spraying or wicking of individual plants, should be continued for small infestations of weeds where this type of control method is suitable and effective. These methods were used on the Site in FY1999 and should be continued in FY2000 for the infestations of Scotch thistle, dame's rocket, and some of the smaller isolated patches of annual rye. Continued evaluation of the effectiveness of these measures should be conducted. The use of this method over the past two years has shown excellent control and reduction in the size of the infestations of Scotch thistle on the Site and should eliminate this species from the Site in the next few years if continued. Russian olive, an exotic tree, which has caused substantial degradation of much of the riparian habitat along the Front Range of

Colorado, also occurs on the Site at a few locations. Hand cutting of the few individuals on the Site, combined with an herbicide applied to the cut stem, should eliminate most of this species from the Site.

A feasibility study will be conducted in FY2000 to determine whether hand pulling or wicking diffuse knapweed can keep an infestation area free of adult, seed producing plants in a year following a herbicide treatment. Because diffuse knapweed seeds remain viable in the soil for up to 10 years, effective control requires prevention of new seed being added to an area for 10 years to allow the seed bank to be exhausted of viable seed. The use of the herbicide Tordon 22K can effectively prevent adult plants from returning to a site for the first year or two after application. However after this point adult plants begin returning in increasing numbers until after 4–5 years the treatment area is essentially back to pre-treatment infestation levels. If areas are sprayed and then let go until the infestation returns to near pre-treatment levels, little is ultimately accomplished. This is because new seed is continually being added to the seed bank after the plants recover from spraying, and the 10-year clock is constantly reset. However, if after initial herbicide treatment, hand pulling or wicking can be used to prevent adult plants from setting seed, it would be possible to prevent additional seed from infesting an area and keep the infestation at a more acceptable level. By using this method over time, large-scale herbicide application may eventually become unnecessary. Evaluation of this method will take place at a location that was treated with Tordon 22K by helicopter in May 1999.

Prescribed Burns

The use of prescribed burns on Site grasslands is highly recommended as a management tool to help control weeds, reduce plant litter, recycle nutrients, and improve the health and vigor of the native plant communities. Approximately 500 acres in the xeric tallgrass prairie plant community are to be burned in FY2000 (Figure 3).

The specific burn prescription plan will be developed based on the specific management objectives of the burn. A properly timed prescribed burn can stress many of the undesirable weedy species in the plant communities while promoting the growth of the desired native species. Combined with the herbicide treatments and other weed control measures, the use of fire should help to reduce the weed problem at the Site while improving the vigor and competitiveness of native species, thus improving the overall health and condition of the plant communities at the Site.

A prescribed burn plan will be written for any burn planned at the Site. The prescribed burn plan will detail every aspect of the burn prescription. All Site and state regulations governing prescribed burns will be followed. (Colorado state regulations prohibit burning from November 1 to March 1 because of pollution concerns [CAQCC 1995]). In addition, nesting bird mortality will also be taken into consideration (USC 1973). All proper permits will be obtained, and all logistical details coordinated with onsite and offsite agencies, organizations, and the public. The effectiveness of the prescribed burns will be assessed as part of the K-H Ecology Group's ongoing monitoring of the ecological resources at the Site.

Reclamation and Revegetation

Reclamation and revegetation of the closed roads, roadside edges, and noxious weed-infested areas in the Buffer Zone would help reduce future weed control costs.

Revegetation of these areas speeds the natural process of succession and helps to move these areas beyond the early successional stage that encourages weed growth. Reseeding or transplanting native species into these areas encourages them to return to native plant communities more quickly, allowing the desirable species to better compete with the weeds. Currently, all projects that disturb soil are required to reclaim and revegetate their project areas. As budget and time permit, other disturbed and/or low-quality areas in the Buffer Zone will be reclaimed.

One potential area for Buffer Zone revegetation in FY2000 is on the old gravel test pits located on the western edge of the Site. In recent years these test pits have become infested with diffuse knapweed and are seed sources for the surrounding xeric tallgrass prairie. These areas are slated for aerial herbicide application during spring 2000. These test pit areas could be reseeded in the fall of 2000 with native species to restore desired vegetation on them and help out compete the weeds.

Biological Controls (Insects)

Biological control agents (i.e., insects) are being used on the Site to assist in the control of musk thistle (*Carduus nutans*), St. John's-wort (*Hypericum perforatum*), dalmatian toadflax (*Linaria dalmatica*), and diffuse knapweed. The insects have been provided to the Site by the Colorado Department of Agriculture (CDA) to target specific weed infestations.

It is recommended that cooperative efforts with the CDA continue with regard to the release of biological control agents for weed control at the Site. Additional releases of insects and other biological control agents for the above-listed and other species could increase the effectiveness of the weed control efforts while potentially reducing costs. Release of new insects now available for controlling Canada thistle (*Cirsium arvense*) and other target species would provide an additional control method for these species. If these insects are available, and if the Site could be used as a testing ground for these or other biological controls, these agents could be used in addition to chemicals, at little or no extra cost. Thus, continued cooperation with CDA could result in considerable long-term cost savings for weed control. Additionally, communication with local researchers who are evaluating the use of biocontrols on nearby Open Space properties should be continued to keep abreast of any new findings and techniques. Table 6 lists the biological controls currently available for weed control at the Site. Those that have been released on the Site are highlighted.

One specific location where additional biocontrol agents should be released in FY2000 is east of the Lindsay Ranch in Rock Creek. A large hillside infestation of common St. John's-wort has been present for the last few years based on the results of the permanent photo monitoring (Figures 4 and 5). Observations have shown that few of the foliage feeding beetles, *Chrysolina quadrigemina*, are present at this location, however.

Collection and transfer of beetles from other populations on the Site to this location should be made to bring this infestation under greater control. Observations of common St. John's-wort infestations elsewhere on the Site, where the insect is present in greater numbers, have shown the insect does a good job of reducing and controlling the infestations.

Chemical Controls

The Ecology Group maintains a list of herbicides approved for use on the Site. Herbicides *not* on the current list (Table 7) *may not* be used until they are approved. Many of these chemicals require special licensing, and must be applied only by a licensed applicator. Such herbicides may not be applied onsite by unlicensed applicators. Herbicides cannot be stored or maintained onsite, empty containers may not be washed onsite, and used containers must be removed by the applicator at the end of the work shift. Disposal is strictly the responsibility of the applicator.

Knapweed Treatment

Diffuse knapweed infestations on the Site are so serious that continued application of herbicides (Tordon 22K and Transline) to portions of the Buffer Zone during FY2000 is recommended. During FY1997 and FY1998 combined, more than 536 acres of prairie in the Buffer Zone were treated with herbicides using vehicle-mounted equipment. Results of monitoring have shown large decreases in the amounts of diffuse knapweed present in treated areas. The large reduction in the abundance of reproducing adult plants in these areas has reduced annual seed production, reduced the likelihood of the spread of the infestation from these areas (due to no adult plants being available to blow away), and dramatically improved the appearance of the grassland. During FY1999, both ground application and aerial application (by helicopter) of herbicides was used to treat more than 1,500 acres infested with diffuse knapweed and other weed species.

During FY2000, the K-H Ecology Group will provide maps, prescribed herbicides, and application rates to RFCSS (the group responsible for the herbicide contractor at the Site) for herbicide application by vehicle-mounted equipment and backpack spraying in the Buffer Zone. Figure 6 shows recommended locations for ground application of herbicides at the Site during FY2000. A total of approximately 362 acres are slated for ground application of herbicides in FY2000.

In addition, aerial herbicide application plans will be developed and provided to RFCSS for the continuation of aerial herbicide applications across larger portions of weed infested areas at the Site. Aerial application of herbicides to the Site will be conducted under stringent guidelines (flight plan and Integrated Work Control Package [IWCP]). Areas slated for aerial application in FY2000 are shown in Figure 7. Approximately 1022 acres are proposed to receive aerial herbicide application in FY2000. Appendix A contains the current guidelines for aerial application of herbicides on the Site.

Herbicide Applications for Other Target Weed Species

In many cases where herbicides are applied to control diffuse knapweed, no additional effort is required for other target weed species, because these species are also affected by the knapweed treatments. However, application of other species-specific herbicides may be necessary for species that are not affected by the knapweed treatment.

Herbicide application for some of the less aggressive target species will be limited mostly to road shoulders, roadsides, disturbed areas, storage yards, and areas adjacent to or in the Industrial Area. In some cases, where ecological conditions allow, populations of these species within the native plant communities may be spot treated with herbicides. The goal of such applications will be to reduce or eliminate small populations that might otherwise expand aggressively, and/or to improve the quality of the native communities. This application strategy will be employed as needed throughout the growing season.

A Russian knapweed population that was discovered on Site during FY1998 will be treated again with Tordon 22K during FY2000 to reduce the stand and keep it from spreading. The timing of application should be conducted prior to flowering of the species. At the Canada thistle infestation mentioned in the mowing section above, chemical control will be combined with mowing for better control. The Colorado State University Cooperative Extension Service recommends that fall herbicide application combined with mowing is an effective method for Canada thistle (Beck 1996). A portion of the infestation will be treated in this manner.

References

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Table 1. Weed control methods for the Site

Treatment Option	Control Method
Administrative Controls	Administrative policies and procedures
Cultural Controls	Reclamation and revegetation requirements
Physical or Mechanical Controls	Grading
	Mowing
	Prescribed Burns
	Hand-pulling
Biological Controls	Insects
Chemical Controls	Herbicide application

Table 2. Noxious Weeds Occurring at Rocky Flats Environmental Technology Site

+Annual Rye (*Secale cereale*)
*Blue mustard (*Chorispora tenella*)
*Bouncingbet (*Saponaria officinalis*)
*Bull thistle (*Cirsium vulgare*)
*Canada thistle (*Cirsium arvense*)
*Chicory (*Cichorium intybus*)
*Common burdock (*Arctium minus*)
*Common mullein (*Verbascum thapsus*)
*Common St. Johnswort (*Hypericum perforatum*)
*Dalmatian toadflax (*Linaria dalmatica*)
*Dame's rocket (*Hesperis matronalis*)
*Diffuse knapweed (*Centaurea diffusa*)
*Downy brome (*Bromus tectorum*)
*Field bindweed (*Convolvulus arvensis*)
*Flixweed (*Descurainia sophia*)
*Green foxtail (*Setaria viridis*)
*Hoary cress (*Cardaria draba*)
*Houndstongue (*Cynoglossum officinale*)
*Jointed goatgrass (*Aegilops cylindrica*)
*Kochia (*Kochia scoparia*)
*Longspine sandbur (*Cenchrus longispinus*)
*Mayweed chamomile (*Anthemis cotula*)
*Musk thistle (*Carduus nutans*)
*Oxeye daisy (*Chrysanthemum leucanthemum*)
*Poison hemlock (*Conium maculatum*)
*Puncturevine (*Tribulus terrestris*)
*Quackgrass (*Elytrigia repens*)
*Redstem filaree (*Erodium cicutarium*)
*Russian knapweed (*Centaurea repens*)
+Russian olive (*Elaeagnus angustifolia*)
*Russian thistle (*Salsola iberica*)
*Saltcedar (*Tamarix ramosissima*)
*Scotch thistle (*Onopordum acanthium*)
*Yellow toadflax (*Linaria vulgaris*)

* Noxious weeds as listed by the State of Colorado Noxious Weed Act.

+ Additional species considered a noxious weed at the Site.

Table 3. Top Ten Prioritized Weed Species for the State of Colorado

*Canada thistle (*Cirsium arvense*)
*Diffuse knapweed (*Centaurea diffusa*)
*Field bindweed (*Convolvulus arvensis*)
*Hoary cress (*Cardaria draba*)
*Jointed goatgrass (*Aegilops cylindrica*)
Leafy spurge (*Euphorbia esula*)
*Musk thistle (*Carduus nutans*)
*Russian knapweed (*Centaurea repens*)
Spotted knapweed (*Centaurea maculosa*)
*Yellow toadflax (*Linaria vulgaris*)

* Species known to occur at Rocky Flats Environmental Technology Site.

Table 4. Alien Plants Ranking System Results for Selected Noxious Weeds at Rocky Flats Environmental Technology Site

<u>Species</u>	<u>Impact</u>	<u>Control</u>	<u>Pest</u>
Diffuse Knapweed	82	72	78
Canada Thistle	69	73	78
Russian Knapweed	47	59	79
Dalmatian Toadflax	45	63	65
Annual Rye	44	31	52
Chicory	33	59	60
Musk Thistle	33	56	63
St. John's Wort	33	43	70
Common Mullein	31	63	49
Scotch Thistle	31	43	57
Field Bindweed	29	60	52
Bouncing Bet	24	61	52
Dame's Rocket	24	56	52
Bull Thistle	22	36	57
Jointed Goatgrass	18	41	52
Hoary Cress	16	41	46

**Table 5. FY2000 List of Noxious Weeds Prioritized for Control at Rocky Flats
Environmental Technology Site**

Priority 1 Species

- *Canada thistle (*Cirsium arvense*)
- *Diffuse knapweed (*Centaurea diffusa*)
- *Russian knapweed (*Centaurea repens*)

Priority 2 Species

- +Annual Rye (*Secale cereale*)
- *Bouncingbet (*Saponaria officinalis*)
- *Common mullein (*Verbascum thapsus*)
- *Common St. Johnswort (*Hypericum perforatum*)
- *Dame's rocket (*Hesperis matronalis*)
- *Musk thistle (*Carduus nutans*)
- +Russian olive (*Elaeagnus angustifolia*)
- *Scotch thistle (*Onopordum acanthium*)

Priority 3 Species

- *Blue mustard (*Chorispora tenella*)
- *Bull thistle (*Cirsium vulgare*)
- *Chicory (*Cichorium intybus*)
- *Common burdock (*Arctium minus*)
- *Dalmatian toadflax (*Linaria dalmatica*)
- *Downy brome (*Bromus tectorum*)
- *Field bindweed (*Convolvulus arvensis*)
- *Flixweed (*Descurainia sophia*)
- *Green foxtail (*Setaria viridis*)
- *Hoary cress (*Cardaria draba*)
- *Houndstongue (*Cynoglossum officinale*)
- *Jointed goatgrass (*Aegilops cylindrica*)
- *Kochia (*Kochia scoparia*)
- *Longspine sandbur (*Cenchrus longispinus*)
- *Mayweed chamomile (*Anthemis cotula*)
- *Oxeye daisy (*Chrysanthemum leucanthemum*)
- *Poison hemlock (*Conium maculatum*)
- *Puncturevine (*Tribulus terrestris*)
- *Quackgrass (*Elytrigia repens*)
- *Redstem filaree (*Erodium cicutarium*)
- *Russian thistle (*Salsola iberica*)
- *Saltcedar (*Tamarix ramosissima*)
- *Yellow toadflax (*Linaria vulgaris*)

* Noxious weeds as listed by the State of Colorado Noxious Weed Act.

+ Additional species considered a noxious weed at the Site.

Table 6. Biological Control Agents for Use at the Site

Target Species	Beneficial Organism	Effect
Diffuse knapweed (<i>Centaurea diffusa</i>)	<i>Urophora affinis</i> and <i>Urophora quadrifasciata</i>	Attacks knapweed flowers, producing galls that reduce seed production.
	<i>Sphenoptera jugoslavica</i>	Beetle larvae bore into root crown and upper roots of knapweed, retarding plant development and stunting growth.
	<i>Bangasternus fausti</i>	Adults lay eggs in knapweed flowers. Larvae feed within flower receptacle, destroying seeds.
Musk thistle (<i>Carduus nutans</i>)	<i>Rhinocyllus conicus</i>	A weevil that eats the seeds in the musk flower heads.
	<i>Trichosiromus horridus</i>	Weevil that attacks the crown of musk thistle, thus killing the apical meristem and reducing the potential of the plant to flower.
	<i>Cassida rubiginosa</i>	Leaf-eating beetle that eats the musk thistle leaves.
Canada thistle (<i>Cirsium arvense</i>)	<i>Ceutorhynchus litura</i>	A leaf- and stem-mining weevil.
	<i>Urophora cardui</i>	A gall fly.
St. Johns-wort (<i>Hypericum perforatum</i>)	<i>Agrilus hyperici</i>	A flower-feeding weevil.
	<i>Chrysolina quadrigemina</i>	A foliage-feeding beetle.
	<i>Zeuxidiplosis giardi</i>	A gall-forming fly.
Russian thistle (<i>Salsola iberica</i>)	<i>Coleophora klimeschiella</i>	Foliage-feeding, case-bearing moth.
	<i>Coleophora parthenica</i>	Stem-boring moth.
Puncturevine (<i>Tribulus terrestris</i>)	<i>Microlarinus lareynii</i>	Seed-feeding weevil.
	<i>Microlarinus lypriformis</i>	Stem-boring weevil.
Dalmatian toadflax (<i>Linaria dalmatica</i>)	<i>Calophasia lunula</i>	Larvae of this moth feed on the leaves and flowers of the plant.

Table 7. Approved Herbicides for Use at Rocky Flats (Last updated 01/19/00)

<u>Herbicide Name</u>	<u>Active Ingredient</u>
Arsenal	Imazapyr
Banvel	Dicamba
Buctril	Bromoxynil
Escort	Metsulfuron
Gallery	Isoxaben
Karmex	Diuron
Oust	Sulfometuron
Plateau	Imidazolinone
Rodeo	Glyphosphate
Roundup	Glyphosphate
Surflan	Oryzalin
Telar	Chlorsulfuron
Transline	Clopyralid
Tordon 22K	Picloram

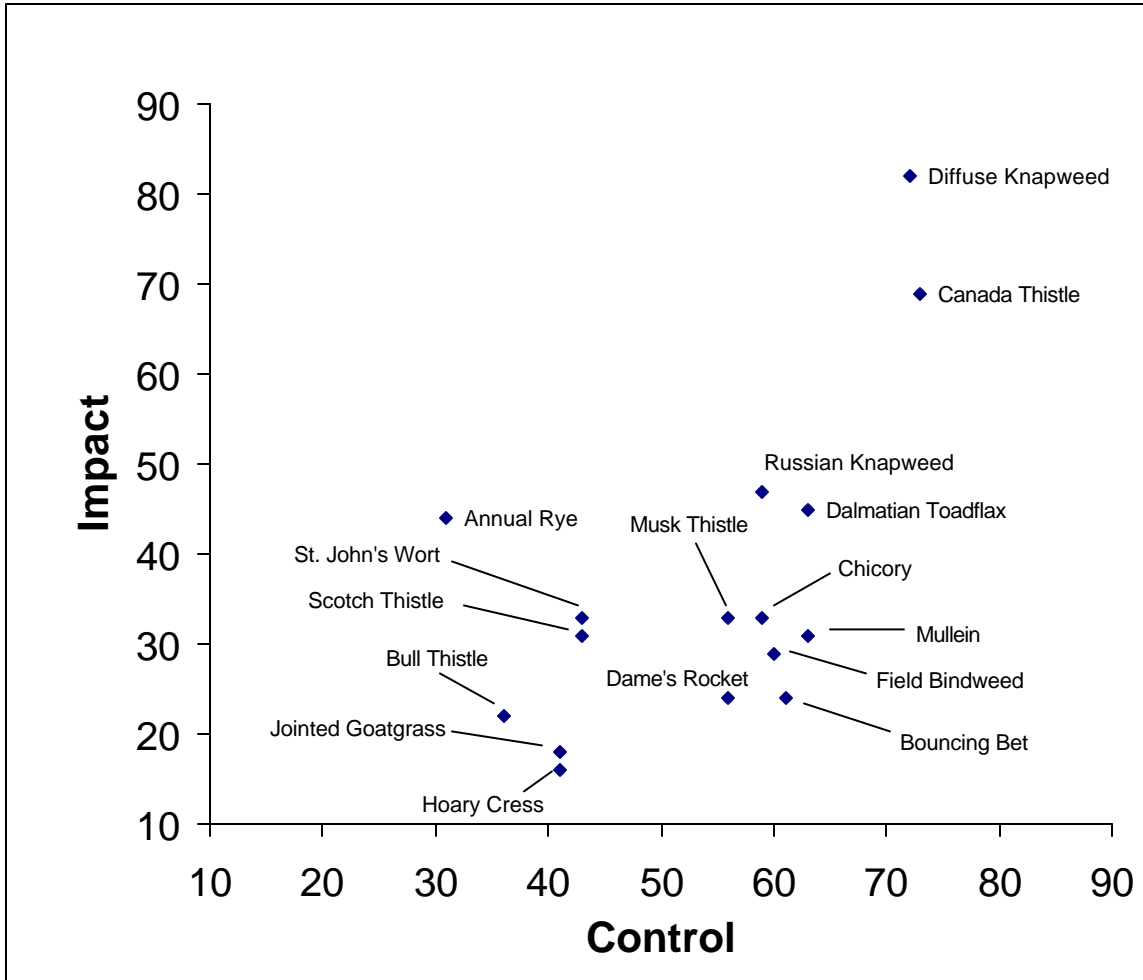


Figure 1. Alien Plants Ranking System Results for Selected Noxious Weeds at Rocky Flats Environmental Technology Site

Note: This chart depicts the impact of the noxious weed versus its difficulty of control.

FY2000 Road Grading
and Mowing Operations for
Weed Control

Figure 2

MAP LEGEND

- Road Grading and Roadside Mowing
- Roadside Mowing
- Canada Thistle Mowing
- Annual Rye Mowing

Standard Map Features

- Buildings
- Lakes & Ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft)

DATA SOURCE:
Mowing and grading locations provided by Exponent.
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs, 1/95
Hypsography derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Note:
The boundaries are approximate. The numbers are the approximate number of acres for each area.



1:23552
1000 0 1000 2000 Feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

For:



Kaiser-Hill
Company, LLC









FY2000 Prescribed Burn Locations

Figure 3

MAP LEGEND

 Prescribed Burn Locations

Standard Map Features

-  New Landfill
-  Buildings
-  Lakes & Ponds
-  Streams & ditches
-  Fences
-  Paved roads
-  Dirt roads
-  Contours (20 ft)
-  Power Lines

DATA SOURCE:
Prescribed burn areas provided by Exponent.
Buildings, fences, hydrography, roads and other structures from 1984 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs, 1/85
Hypsography derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Note:
The boundaries are approximate. The numbers are the approximate number of acres for each area.



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State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

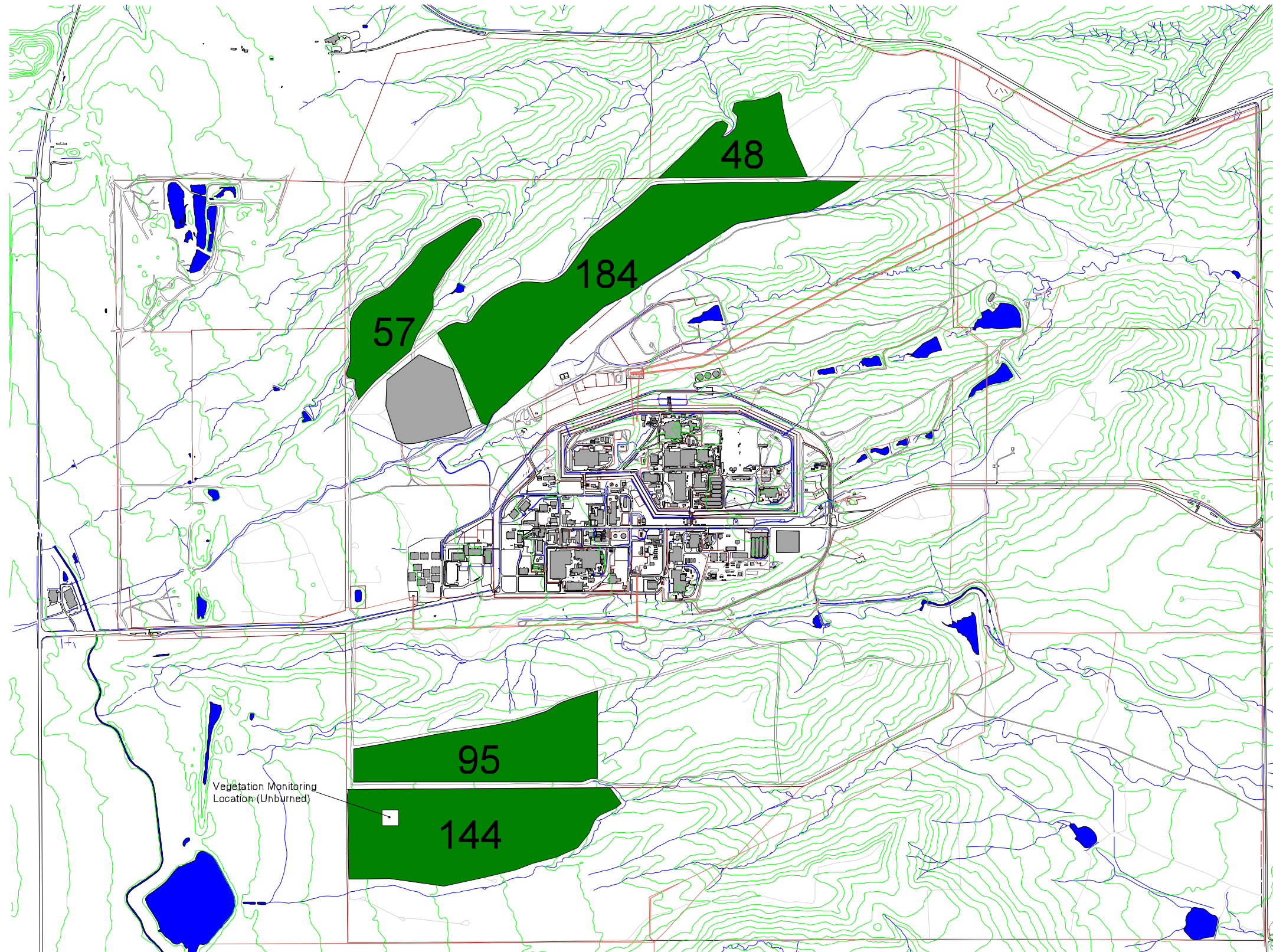
Prepared by:

For:

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Company, LLC

Vegetation Monitoring
Location (Unburned)





1997

Figure 4. St. John's-wort infestations (dark yellowish areas on hillside) present on the hillside near Lindsay Ranch in 1997.



1999

Figure 5. The St. John's-wort infestations (dark areas on hillside) are still present at the same locations on the hillside as they were in 1997. Few of the plants had any of the biocontrol insects present on them in 1999.

FY2000 Ground Herbicide Application Areas

Figure 6

MAP LEGEND

- Tordon 22K Spray Areas
- Transline Spray Areas

Standard Map Features

- Buildings
- Lakes & Ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft)
- Power Lines

DATA SOURCE:
2000 spray areas provided by Exponent.
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs, 1/95
Hypsography derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. The DEM post-processing performed by MK, Winter 1997.

Note:
The boundaries are approximate. The numbers are the approximate number of acres for each area.



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State Plane Coordinate Projection
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Spring 2000 Aerial Herbicide Application Locations Figure 7

MAP LEGEND

- Tordon Spray Areas
- Transline Spray Areas
- 1999 Aerial Spray Locations

Standard Map Features

- Buildings
- Lakes & Ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft)
- Power Lines

DATA SOURCE:
Aerial Herbicide Locations provided by Exponent.
Buildings, fences, hydrography, roads and other
structures from 1994 aerial fly-over data
captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs, 1/85
Hypsography derived from digital elevation model
(DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN
and LATTICE to process the DEM data to create 5-foot contours.
The DEM data was captured by the Remote Sensing Lab,
Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution.
The DEM post-processing performed by MK, Winter 1997.

Note:
These locations are approximate.
The numbers are the approximate number
of acres for each location.



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1000 0 1000 2000 Feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared
by:

Exponent

For:

Kaiser-Hill
Company, LLC

MAP ID: K2-0016

February 23, 2000

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Appendix A

Aerial Herbicide Application

AERIAL HERBICIDE APPLICATION PLAN FOR FY2000

PURPOSE

The purpose of using aerial herbicide application is to allow safe herbicide application over large areas that are inaccessible to ground equipment, and to increase the cost effectiveness of the weed control effort at the Site. This document is intended to become a portion of the Integrated Work Control Package (IWCP) for this work.

LIMITATIONS

Herbicides shall be mixed and applied only in strict accordance with the manufacturer's instructions and with the approval of the Contractor's Technical Representative CTR. All required personal protection equipment (PPE) shall be used, and the Subcontractor's Health and Safety Plan shall be followed. The Subcontractor is responsible for the proper disposal of all used PPE, equipment, and empty herbicide containers. The Subcontractor is responsible for any spills caused by himself or his employees, and will apply with all applicable Federal, State, and local laws and regulations when handling and using chemicals.

The Subcontractor shall use only herbicides that have been approved for use at the Site, and only at the rates prescribed in this plan. Locations for application of herbicides, including buffer areas and set-backs from specific areas, are identified in the following section. No application shall occur over open water, including wetlands, ponds, water-filled ditches, and streams. Application of herbicides shall be terminated when wind speeds approach 15 miles per hour, or per application label directions, whichever is lesser.

The pilot shall strictly observe all no-fly areas and other flight restrictions identified in the Flight Safety Plan for Aerial Herbicide Application.

APPLICATION AREAS

Application areas are shown on Figure 7, with each area showing the size in acres. Pink areas (i.e., the 14 and 70 acre plots shown) shall have Transline applied at a rate not to exceed 1 pint per acre. Yellow areas (i.e., all other marked areas) shall have Tordon 22K applied at a rate not to exceed 1 pint per acre. No application shall occur within 100 feet of riparian vegetation. The applicator shall accompany the CTR and subject matter experts from the Kaiser-Hill Ecology Group on a driving orientation tour before any aerial application is done. During this orientation tour, the buffer areas shall be clearly identified for the applicator.